

# Flight Standardization Board (FSB) Report

Revision: original Date: 08/13/2013

## Gulfstream G-IV (G-1159C)

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### **RECORD OF REVISIONS**

Revision Number	Sections	Pages	Date
Original	ALL	ALL	08/13/2013

### **HIGHLIGHTS OF CHANGE**

This is the original G-IV (G-1159C) FSB Report.

### **CONTENTS**

SEC	PAGE
	RECORD OF REVISIONS
	HIGHLIGHTS OF CHANGE
	CONTENTS
1.	PURPOSE AND APPLICABILITY5
2.	PILOT TYPE RATING REQUIREMENT
3.	MASTER DIFFERENCE REQUIREMENTS (MDR)
4.	OPERATOR DIFFERENCE REQUIREMENTS (ODR) TABLES
5.	FSB SPECIFICATIONS FOR TRAINING7
6.	FSB SPECIFICATIONS FOR CHECKING8
7.	FSB SPECIFICATIONS FOR CURRENCY8
8.	FSB SPECIFICATIONS FOR RECENT EXPERIENCE8
9.	AIRCRAFT REGULATORY COMPLIANCE CHECKLIST9
10.	FSB SPECIFICATIONS FOR TRAINING DEVICES AND SIMULATORS9
11.	APPLICATION OF FSB REPORT9
12.	ALTERNATE MEANS OF COMPLIANCE
13	MISCELL ANEOLIS

### **CONTENTS**

APPENDIX 1.	MASTER DIFFERENCE REQUIREMENTS (MDR) TABLE10 [Reserved]
APPENDIX 2.	SAMPLE OPERATOR DIFFERENCE REQUIREMENTS (ODR) TABLES [Reserved]
APPENDIX 3.	AIRCRAFT COMPLIANCE CHECKLIST 12
APPENDIX 4.	HONEYWELL 2020 HEAD UP DISPLAY (HUD)
APPENDIX 5.	KOLLSMAN ENHANCED VISION SYSTEM (EVS)15
APPENDIX 6.	G-IV DISPLAY UNIT DU-885 MODIFICATION17
APPENDIX 7.	HONEYWELL NZ-2000 FMS 6.1 SOFTWARE WITH SBAS/LPV GPS18

### Gulfstream Aerospace G-IV (G-1159C) FSB Report

### 1. PURPOSE AND APPLICABILITY

1.1 This report specifies master training, checking, and currency requirements applicable to crews operating G-IV (G-1159C) aircraft under 14 CFR part 91, 125, and 135. Provisions of this report:

- a) Identify the pilot "type rating" assigned to the G-IV (G-1159C),
- b) Describe any unique requirement applicable to initial, differences or recurrent training,
- c) Describe "Master Difference Requirements" for flight crews requiring differences qualification for mixed-fleet-flying or differences, if applicable,
- d) Provide examples of Operator Difference Requirements (ODR) tables, if applicable,
- e) Describe acceptable training program and training device characteristics when necessary to establish compliance with applicable regulations, and MDR tables, if applicable.
- f) Identify checking and currency standards to be applied by the FAA or operators and,
- g) Provide a listing of regulatory compliance status (compliance checklist) for 14 CFR part 91, 125, & 135, Advisory Circulars, and other operationally related criteria.
- 1.2 This report addresses G-IV (G-1159C) aircraft as specified in FAA Type Certificate Data Sheet (TCDS) # A12EA.
- 1.3 The provisions of this Flight Standardization Board (FSB) report are effective until amended, superseded, or withdrawn by subsequent revisions to this report.
- 1.4 Determinations made in this report are based on the evaluations of a G-IV (G-1159C) aircraft equipped in a production configuration and in accordance with current regulations and guidance. Modifications and differences made to the model described herein, or introduction of new related aircraft, may require amendment of the findings in this report. The FSB reserves responsibility/authority to re-evaluate and modify sections of this report based on new or revised Advisory Circular material or revisions to 14 CFR part 91, 125, & 135, aircraft operating experience, or the testing of new or modified aircraft under the provisions of AC 120-53, Guidance for Conducting and Use of Flight Standardization Board Evaluations, as revised.
- 1.5 Terminology. The term "must" is used in this FSB report and certain MDR footnotes even though it is recognized that this report provides one acceptable means, but not necessarily the only means of compliance with 14 CFR part 91, 125, and 135 requirements. This terminology acknowledges the need for operators to fully comply with this FSB report and MDR and ODR provisions, if applicable, if AC 120-53 is to be used by the operator as the means of complying with 14 CFR part 91, 125 and 135 requirements.

### 1.6 This report includes:

a) minimum training, checking, and currency requirements for FAA field offices to use for approving operator programs (e.g. MDRs, Type Rating designations, etc.),

- b) general advisory information which may be approved for that operator (e.g. MDR footnotes, ODR tables), and
- c) information which is used to facilitate FAA review of an aircraft type or related aircraft that is proposed for use by an operator (e.g. compliance checklist).

### 1.7 Relevant acronyms are defined as follows:

AC Advisory Circular	C	Advisory Circular
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ACO Aircraft Certification Office AFM Airplane Flight Manual

AP Autopilot

CFR Code of Federal Regulations CHDO Certificate Holding District Office

DC Display Controller

EFIS Electronic Flight Instrument System

EGPWS Enhanced Ground Proximity Warning System EICAS Engine Indicating and Crew Alerting System

FADEC Full Authority Digital Engine Control

FGS Flight Guidance System
FMA Flight Mode Annunciator
FMS Flight Management System
FSB Flight Standardization Board
FTD Flight Training Device
IRS Inertial Reference System
ISDU Inertial System Display Unit

LPV Localizer Performance with Vertical Guidance

MMEL Master Minimum Equipment List
MCDU Multi-Function Control Display Units
MDR Master Differences Requirements

MFF Mixed Fleet Flying ND Navigation Display

ODR Operator Differences Requirements

PFD Primary Flight Display
POI Principal Operations Inspector
QRH Quick Reference Handbook

SBAS Satellite Based Approach System

SG Symbol Generator

TAWS Terrain Awareness and Warning System
TCAS Traffic Alert and Collision Avoidance System

TCE Training Center Evaluator

TCPM Training Center Program Manager

VNAV Vertical Navigation

WAAS Wide Area Augmentation System

WOW Weight on Wheels

### 2. PILOT "TYPE RATING" REQUIREMENTS

- 2.1 In accordance with the provisions of the 14 CFR part 61, FAA Order 8900.1, and AC 120-53, a new pilot type rating is assigned to the G-IV (G-1159C) aircraft and is designated "G-IV".
- 2.2 In that this is a new pilot type rating, the FSB did not evaluate, and does not allow for any training credits, checking credits, currency credits, landing currency credits, or proving test credits (except that which is permitted by 14 CFR § 135.145) between the G-IV and any other similar type aircraft from Gulfstream.

### 3. "MASTER DIFFERENCE REQUIREMENTS" (MDR)

Reserved for future aircraft.

### 4. OPERATOR DIFFERENCE REQUIREMENTS (ODR) TABLES

Reserved for future related aircraft.

### 5. FSB SPECIFICATIONS FOR TRAINING

- 5.1 General
- 5.1.1 The provisions of this section apply to programs for airmen who have experience in multiengine transport turbojet aircraft, EFIS, and FMS. Additional requirements may be appropriate for airmen not having this experience.
- 5.1.2 Reserved.

### 5.2 Pilots Initial Training

- 5.2.1 G-IV (G-1159C) ground training is accomplished as specified by 14 CFR § 135.345 and any Areas of Emphasis identified in paragraph 5.5.
- 5.2.2 G-IV (G-1159C) flight training is accomplished as specified by 14 CFR § 135.347 and any Areas of Emphasis identified in paragraph 5.5.
- 5.2.3 Emergency training is accomplished as specified by 14 CFR § 135.331.
- 5.2.4 Seat Dependent Tasks training.

The FSB has not found any seat dependent tasks for the G-IV (G-1159C).

5.3 Differences Training (14 CFR § 135.347).

Reserved for future related aircraft.

### 5.4 Recurrent Training:

- 5.4.1 Recurrent Ground Training must include appropriate training in accordance with 14 CFR § 135.351 and any Areas of Emphasis in paragraph 5.5 if applicable.
- 5.4.2 Recurrent Flight Training must include appropriate training in accordance with 14 CFR § 135.351 and any Areas of Emphasis in paragraph 5.5 if applicable.
- 5.5 Areas of Emphasis.
- 5.5.1 No ground training areas of emphasis were found.
- 5.5.2 No flight training areas of emphasis were found.
- 5.6 Specific Flight Characteristics for training. (See Section 6.2 for checking requirements)
  - All items listed in paragraph 5.5.2

### 6. FSB SPECIFICATIONS FOR CHECKING

- 6.1 General
- 6.1.1 Checking must be conducted in accordance with 14 CFR part 61, Practical Test Standards and 14 CFR part 135, as applicable and Specific Flight Characteristics in paragraph 6.2
- 6.2 Specific Flight Characteristics (Ref. FAA Practical Test Standards)
  - LANDING NO FLAP OR NON STANDARD FLAP APPROACH The FSB has determined that the probability of flap extension failure on the G-IV (G-1159C) is not extremely remote due to system design. Therefore, demonstration of a no flap approach and landing during pilot certification or a 14 CFR part 135 proficiency check is required. In accordance with Order 8900.10, when the practical test is conducted in an airplane, verses a simulator, touchdown from a no flap approach is not required and shall not be attempted. The approach should be flown to the point where the inspector or examiner can determine whether a touchdown at an acceptable point on the runway and a safe landing to a full-stop could be made.

### 7. FSB SPECIFICATIONS FOR CURRENCY

The FSB has found no additional currency requirements for the G-IV (G-1159C), other than those already specified in 14 CFR part 61 and 135.

### 8. FSB SPECIFICATIONS FOR RECENT EXPERIENCE

The FSB has found no additional "Recent Experience" requirements for the G-IV (G-1159C), other than those already specified in 14 CFR part 61 and 135.

### 9. AIRCRAFT REGULATORY COMPLIANCE CHECKLIST

9.1 Regulatory Compliance Checklist (see Appendix 3).

#### 10. FSB SPECIFICATIONS FOR DEVICES AND SIMULATORS

The FSB has found no unique or specific device or simulator requirements for the G-IV (G-1159C).

### 11. APPLICATION OF FSB REPORT

- 11.1 All G-IV (G-1159C) operators are subject to the provisions of this report. This report becomes effective on the date of approval (see Cover Sheet or Record of revisions page).
- 11.2 All FAA Approved Training Programs must incorporate the latest FAA Approved AFM Procedures, AFM checklists, manufacturer's recommendations for training maneuvers and all provisions of this report.

#### 12. ALTERNATE MEANS OF COMPLIANCE

- 12.1 Alternate means of compliance to the requirements of this report must be approved by the FSB. If alternate compliance is sought, operators must show that the proposed alternate means provides an equivalent level of safety to the provisions of AC 120-53 (as amended) and this FSB report. Analysis, demonstrations, proof of concept testing, differences documentation or other evidence may be required.
- 12.2 Equivalent Safety Significant restrictions may apply in the event alternate compliance is sought, and the reporting requirements may be increased to ensure equivalent safety. FAA will generally not consider relief through alternate compliance unless sufficient lead-time has been planned by an operator to allow for any necessary testing and evaluation.
- 12.3 Interim Programs In the event of clearly unforeseen circumstances in which it is not possible for an operator to comply with provisions of this report, the operator may seek an interim program approval rather than a permanent alternate compliance method. Financial arrangements, scheduling adjustments and other such reasons are not considered "unforeseen circumstances" for the purposes of this provision. Interim program approvals must be approved by the FSB Chairman.

### 13. MISCELLANEOUS

- 13.1 Landing Minima Categories, ref 14 CFR § 97.3. The G-IV (G-1159C) is considered Category D aircraft for the purposes of determining "straight-in landing weather minima".
- 13.2 Forward Observer Seat The G-IV (G-1159C) forward observer seat is part of the type certificated design. The FSB evaluated the Forward Observer Seat using the criteria in AC 120-83, Flight Deck Observer Seat and Associated Equipment, and found that it is operationally suitable for 14 CFR §§ 125.317(b) and 135.75(b).

Page 9 of 18
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### **APPENDIX 1**

### MASTER DIFFERENCE REQUIREMENTS (MDR) TABLE

This section reserved for future related aircraft.

### **APPENDIX 2**

### SAMPLE OPERATOR DIFFERENCE REQUIREMENTS (ODR) TABLES

This section is reserved for future related aircraft.

### APPENDIX 3

### AIRCRAFT REGULATORY COMPLIANCE CHECKLIST

Not Accomplished.

### APPENDIX 4 – HEAD-UP DISPLAY (HUD) SYSTEM

The G-IV Flight Standardization Board (FSB) participated in three in-flight evaluations of the Honeywell 2020 HUD System during its development between December 1995 and September 1996, using Honeywell's CE-650 and G-IV aircraft. In March 1997, the FSB conducted certification flight tests, along with the Los Angeles Aircraft Certification Office (ACO), in Honeywell's G-IV aircraft. Flight testing consisted of approximately 40 HUD approaches at seven different airports, using CAT I and CAT II procedures, during day, night, Visual Meteorological Conditions (VMC) and Instrument Meteorological Conditions (IMC). Additional evaluations were conducted in Honeywell's HUD simulation facility in Glendale, Arizona.

The FSB also evaluated Honeywell's proposed Gulfstream G-IV Airplane Flight Manual (AFM) Supplement for HUD Operations and Gulfstream's proposed HUD CAT II appendix to the G-IV AFM Supplement for Category II Operations. Honeywell made a number of FAA required changes to the HUD symbology and proposed AFM Supplements to obtain an FAA Supplemental Type Certificate (STC). Once these changes were made, the FSB found the HUD operationally acceptable for all phases of flight and for U.S. CAT I and CAT II operations.

### **FSB SPECIFICATIONS FOR TRAINING**

Flight crewmember training must be accomplished using a level 'C' simulator, with a daylight visual display, or a level 'D' simulator. The FSB has determined that each pilot in command of an aircraft equipped with a HUD system should receive a minimum of 4 hours of ground school training followed by a minimum of 4 hours of simulator training in the left seat of a level 'C', with a daylight visual display, or level 'D' simulator. A HUD 2020 System equipped aircraft may also be used for in-flight training. In-flight training should consist of a minimum of 4 hours of flying in the left seat of the HUD 2020 System equipped aircraft. A person who progresses successfully through flight training, is recommended by an instructor, and successfully completes the appropriate HUD proficiency check by a person authorized by the Administrator, need not complete the recommended 4 hours of flight training.

The FSB recommends special training emphasis in the following areas:

### **Ground Training:**

- 1) Crew coordination
- 2) Crew briefings and callouts
- 3) Duties of flying and non-flying pilots

### Flight Training:

- 1) Use of caged, uncaged and clear modes (especially in crosswind conditions)
- 2) Use of the pitch limit indicator (PLI) during windshear escape
- 3) Approaches to 'black hole' airports using the FPA
- 4) Use of the acceleration cue as a potential flight path angle (FPA)

Revision: Original Gulfstream Aerospace G-IV (G-1159C) FSB Report

- 5) Relationship of the glide path angle to the symbolic runway
- 6) Use of the flare symbol as a cue (not as guidance) and approaches into the top of an undercast during daylight and night conditions.
- 7) Recovery from unusual attitudes
- 8) TCAS resolution advisory
- 9) Takeoff using the FPA to meet a required climb gradient.

### FSB SPECIFICATIONS FOR CHECKING

Flight crewmember checking requires a proficiency check conducted in a level 'C' simulator, with a daylight visual display, in a level 'D' simulator, or on a HUD 2020 System equipped aircraft. The proficiency check will include at least one takeoff and departure procedure and one instrument approach and landing utilizing the HUD.

### **FSB SPECIFICATIONS FOR CURRENCY**

None

### APPENDIX 5 – KOLLSMAN ENHANCED VISION SYSTEM (EVS)

In late 2002 certification flight tests were conducted on the G-IV EVS. Certification credit was given from the G-V EVS to the G-IV EVS because of the identical components they shared. The G-V FSB EVS evaluation follows: From February 1998 to August 2001 the G-V Flight Standardization Board (FSB) Chairman participated with the FAA Los Angeles Aircraft Certification Office in EVS development, proof of concept, and certification flight tests. Those flights included over 50 EVS approaches conducted at approximately 15 different airports during day, night, Visual Meteorological Conditions (VMC) and Instrument Meteorological Conditions (IMC). Gulfstream's G-V EVS Airplane Flight Manual Supplement was evaluated and found acceptable during the certification flight tests. In September 2001 two G-V FSB members received EVS ground school, simulator, and airplane training from Gulfstream Aerospace Corp. (GAC), in Savannah, GA. The FSB found EVS operationally acceptable.

Flight crewmember training must include a review of Title 14 CFR § 91.175 and a review of the Supplemental Type Certificate (STC) AFM supplement for the GAC STC for the installed EVS system.

Flight crewmember training must be accomplished using a level 'C' simulator, with a daylight visual display, or a level 'D' simulator that has been qualified by the National Simulator Program for EVS, or the aircraft. The FSB has determined that each pilot in command of an aircraft equipped with EVS should receive a minimum of 4 hours of ground school training followed by a minimum of 2 hours of simulator training in the left seat of a level 'C', with a daylight visual display, or level 'D' simulator. An EVS equipped G-IV aircraft may also be used in lieu of a simulator for training. In-flight training should consist of a minimum of 2 hours of flying in the left seat of the EVS System equipped aircraft. The flight portion of the training should consist of a minimum of two (2) day and two (2) night approaches with vertical guidance.

The FSB recommends special training emphasis in the following areas:

### Ground Training:

- 1) Transition from EVS imagery to non-EVS, visual conditions. Maximum use should be made of videotapes of actual EVS approaches
- 2) Crew briefings and callouts
- 3) Duties of flying and non-flying pilots
- 4) Crew coordination
- 5) Visual anomalies such as "noise" and "blooming"
- 6) Importance of cross checking the HUD instrumentation presentations against the EVS visual scene presentation to enable the pilot to recognize malfunctions of the ground based ILS equipment and improper presentation of elements in the visual scene during the approach

### Flight/Simulator Training:

- 1) Transition from EVS imagery to non-EVS, visual conditions and runway acquisition
- 2) Crew briefings and callouts

08/13/2013

- 3) Importance of the "design eye position" in acquiring the proper EVS image
- 4) Use of on/off switch "clear" mode
- 5) Precision and non-precision instrument approaches in both day and night conditions
- 6) Use of caged and uncaged modes in crosswind conditions

NOTE 1: These EVS requirements assume that a pilot entering an EVS training program is trained and proficient in the use of the Honeywell 2020 HUD in accordance with the requirements of paragraph 7 "HUD" of this report. If a pilot is not trained and proficient in the use of the Honeywell 2020 HUD, the HUD training required by paragraph 7 "HUD" of this FSB Report may be accomplished concurrently with the provisions of these EVS training requirements.

NOTE 2: 14 CFR §91.175 (c) states that a pilot may continue an approach below the authorized MDA or continue the approach below the authorized DH if subparagraphs (1), (2), and (3) are met. Subparagraph (1) states, in pertinent part, "The aircraft is continuously in a position from which a descent to a landing on the intended runway can be made....". Subparagraph (2) states, in pertinent part, "The flight visibility is not less than the visibility prescribed in the standard instrument approach procedures being used". Subparagraph (3) states, in pertinent part, "...at least one of the following visual references for the intended runway is distinctly visible and identifiable to the pilot...". All three subparagraphs: (1), (2), and (3) must be met. EVS is certified to allow the pilot to use EVS imagery to see the visual references required by subparagraph (3). It is not certified or authorized and cannot be used to satisfy the flight visibility requirements of subparagraph (2). The pilot must determine flight visibility without the use of EVS imagery.

NOTE 3: The EVS is also certified for use as an aid during all phases of flight: taxi, takeoff, climb, cruise, descent and landing.

NOTE 4: At the time of writing of this FSB Report the FAA had initiated a Notice of Proposed Rulemaking to change 14 CFR § 91.175 and address EVS. This report may have to be modified if the rule is changed.

### FSB SPECIFICATIONS FOR CHECKING

Checking requires a proficiency check conducted in a level 'C' simulator, with a daylight visual display, in a level 'D' simulator, that has been qualified by the National Simulator Program for EVS, or on an EVS equipped aircraft. The proficiency check will include at least one instrument approach to published minimums and landing utilizing the EVS. This check can be accomplished concurrently with a proficiency or competency check under 14 CFR §§ 61.57, 61.58, 121.441, 135.293, or 135.297.

### FSB SPECIFICATIONS FOR CURRENCY

If CFR 14 § 61.57 (c) is being used for currency, at least one of the 6 required instrument approaches must be accomplished using EVS to published minimums.

#### APPENDIX 6 – G-IV DISPLAY UNIT DU-885 MODIFICATION

The DU-885 modification changes the G-IV as follows:

- 1) Replaces six DU-880 cathode ray tubes (CRT) with six DU-885 liquid crystal displays (LCD).
- 2) Adds two Cursor Control Devices, an XM Weather receiver, and a data loader.
- 3) Adds the following functions:
- a) Charts Displays approach charts, airport maps, SIDs, STARs and noise procedures on the Enhanced Navigation Display (ND). Airplane position is also displayed on the charts that are geo-referenced.
- b) Maps Displays the FMS moving map over geopolitical boundaries augmented with navigational aids and XM weather on the ND.
- c) Video Displays multiple video inputs on the ND.
- d) Database configuration Displays database status on the ND and permits uploading charts and map data.
- e) DU maintenance Continuously tests the DU and displays a list of the failed tests on the ND (ground use maintenance function only).

Pilots transitioning from the DU-880 to the DU-885 system should be trained on the differences using any one of the following level "C" differences training devices: interactive computer based instruction, cockpit system simulators, cockpit procedures trainers, part task trainers, or level 2-5 flight training devices. There are no checking or currency requirements for this transition.

Level C differences training is the minimum training level required for G-IV with Display Unit DU-885 Modification equipped aircraft. When flight crews are assigned to the G-IV with Display Unit DU-885 Modification, operators and training providers must ensure that the level of training given is adequate for flight crews to fully understand the differences between these aircraft.

It should be noted that this report only addresses training, checking and currency for G-IV qualified pilots that are transitioning <u>to</u> the G-IV with Display Unit DU-885 Modification equipped aircraft. No training, checking, or currency determinations have been made for pilots transitioning from the G-IV with Display Unit DU-885 Modification equipped aircraft <u>to</u> the G-IV aircraft.

The Electronic Charts function is functionally equivalent to a Class 3 Electronic Flight Bag (EFB) with Type C software applications. For airplanes having the current terminal charts database loaded on the DU885's and operable on both DU 2 and 5, no additional paper charts, class 1 or class 2 EFB are required.

### APPENDIX 7 – HONEYWELL NZ-2000 FMS 6.1 SOFTWARE WITH SBAS/LPV GPS

In August 2012 and October 2012, the Gulfstream G-IV Flight Standardization Board (FSB) evaluated the Honeywell NZ-2000 FMS 6.1 Software with SBAS/LPV GPS, and found the installation to be operationally suitable.

### **BACKGROUND**

The G-IV Flight Management System (FMS) provides lateral and vertical navigation data to the Auto Throttle (AT) system, Automatic Flight Control System (AFCS), and Electronic Display system (EDS). A GPS Landing System Sensor Unit (GLSSU) provides GPS position sensor data to the FMS, and ILS like guidance to the EDS and AFCS to provide Satellite Based Approach System (SBAS) / Localizer Performance with Vertical Guidance (LPV) approach capabilities. The change from a Global Navigation System Sensor Unit (GNSSU) to a GLSSU for the Gulfstream GIV aircraft, form the functional differences encompassed in Aircraft Service Change (ASC) 477, and adds the following functions:

- Addition of Cockpit LPV switch/annunciators
- Software upgrade to NZ-2000 computers (NZ 6.1)
- GNSSU receivers and antennas upgraded to SBAS/LPV capable GLSSUs and antennas
- Updated Magnetic Variation Tables
- Vertical Navigation (VNAV) Temperature Compensation (Departure, Approach, and Missed Approach)
- En Route Vectored Operation
- Vectors to Final (VTF) Approaches
- FMS linked chart functionality(for DU-885 equipped aircraft only)
- Automated HA Leg Sequencing
- Approach Procedures Support for Circling and Tactical Air Navigation (TACAN) approaches, and multiple Area Navigation (RNAV) approaches to the same runway (Multi-RNAV) Approaches)
- SBAS/LPV Operations, DO-229D, Class Delta-4 "ILS look alike"
- Software enhancements to Lateral Guidance and flight planning for curved path calculations.
- Software enhancements to Path computation to reduce vertical splits.
- Software enhancements to system speed, quality and robustness

Pilots transitioning to the Honeywell NZ-2000 FMS 6.1 Software with SBAS/LPV GPS should be trained on the differences using Level "C" training. Level C is interactive (full task) computer based instruction (ICBI). There are no checking or currency requirements for this transition.